Inequality of Opportunity in Health Care in China: Suggestion on the Construction of the Urban-Rural Integrated Medical Insurance System

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(Version I)

Abstract: This paper investigates the urban-rural inequality of opportunity in health care in China based on the theory of equality of opportunity of Roemer (1998). Following the *compensation principle* proposed by Fleurbaey and Schokkaert (2011), this paper establishes a decomposition strategy of the *fairness gap*, which we use for the measurement of the inequality of opportunity in the urban-rural health care use. Empirical analysis using the CHNS data shows that the ratios of the *fairness gap* to the directly observed average urban-rural difference in health care are 1.167 during 1997-2000 and 1.744 during 2004-2006, indicating that the average urban-rural difference observed directly from original statistical data may underestimate the degree of the essential inequity. Meanwhile, the increasing *fairness gap* and the decomposition results imply that generally leveling the urban-rural reimbursement ratios is probably not sufficient, and pro-disadvantage policies should be put in place in order to mitigate or even eliminate the inequality of opportunity in health care use between urban and rural residents. The results are also illuminating for the experiments and establishment of the urban-rural integrated medical insurance system (URIMIS) in China. The pro-disadvantage policies will be more appreciated and effective in the promotion of the equality of opportunity in health care, within the background of urban-rural dualistic social structure and widening urban-rural income gap. This suggestion is supported by data from the URIMIS pilot regions in Jiangsu province. The results show that the *fairness gap* can be narrowed significantly via pro-disadvantage policies.

Key words: equality of opportunity; health care; fairness gap; urban-rural integrated medical insurance system

JEL Classification: D12, D63, I18

Abbreviations: in this paper, we have used some abbreviations for convenience. Among these abbreviations, some are standard and commonly used; while some are not, such as URIMIS (urban-rural integrated medical insurance system), which refers to a newly developed medical insurance system at the service of both urban and rural residents.

1. Introduction

There have long been large urban-rural disparities in health and health care in China due to the deficiency of rural medical insurance system and other urban-rural dualistic systems. These disparities have unfortunately not been reduced effectively in the early stage of health care reform. Although the New Cooperative Medical Scheme (NCMS)—specially established for rural residents—has almost realized a complete coverage, its insurance level is too low to decrease the out-of-pocket health care expenditure. Therefore the current NCMS seems of little help to effectively protect the insureds from the catastrophic health expenditure or poverty caused by diseases (Wagstaff *et al.*, 2009; Lei and Lin, 2009; Yip and Hsiao, 2009). Such situation will inevitably impede the human capital development in rural areas, being useless for the elimination of the *poverty trap* and *relative deprivation*, as well as for the equalization of public services.

There is an urgent need to build an urban-rural integrated medical insurance system (for short, the URIMIS), which is aiming at promoting the urban-rural balanced development in health and health care. Although pilot experiments have sprung up in recent years, the most widely used policy merely focuses on the reimbursement-ratio increasement, especially for rural residents, in order to reach a uniform medical insurance policy between the urban and the rural. However, it is not enough to level the reimbursement ratios for both urban and rural residents to cope with the urban-rural disparities in health and health care. Meanwhile, it will also be misleading if the integrated policy expects to see a similar health care expenditure between urban and rural residents. The pursuit of *outcome equality* (such as the same health care expenditure) and the *reimbursement equality* (such as the same reimbursement ratio) may result in no efficiency, even no equity, since there are intrinsic differences between urban and rural residents due to their individual or circumstance characteristics[1]. Thus we should pay more attention on the realization of the *equality of opportunity* (EOp)—an expression of the essential equality in this paper—in health and health care. This viewpoint is also of great importance during the policy making of the URIMIS. Unfortunately, there have been few discussions and researches on the EOp in the health domain in China. Therefore, this paper intends to evaluate the urban-rural essential inequality in health care based on the theory of the EOp of Roemer (1993, 1998, 2002), and then gives our suggestion on the improvement of the URIMIS policies.

[1] We do not intend to dig into this issue, but we've given several examples in Appendix A as a simple explanation.

It is convinced that the EOp is of vital importance for both academic researches and policy making (World Bank, 2005). However, the development of the EOp in the field of health and health care is still in its infancy, not to mention relevant researches about China. This paper just tries to use this theory to re-examine the urban-rural disparities in health care in China. What's more, the development of the URIMIS is one of the major topics in China in recent years. Although the construction policies are explored among pilot regions, there have been no unified standards for the evaluation and comparison yet. Therefore we also hope that this paper can offer some practical suggestions on the URIMIS construction and the improvement of health care fairness in China.

Based on the theory of the EOp developed by Roemer (1993, 1998, 2002), and the *compensation principle* for the EOp analysis proposed by Fleurbaey and Schokkaert (2009, 2011), this paper calculates and decomposes the urban-rural *fairness gaps* in health care in China. By using data from the China Health and Nutrition Survey (CHNS), the results show that: (1) during the two periods of 1997－2000 and 2004－2006, the ratios of the *fairness gap* to the directly observed average urban-rural difference in health care, when we take urban circumstances as the "ideal" reference circumstances, are 1.167 and 1.744 respectively, indicating that an underestimation would be made if we simply take urban-rural difference, which can be directly observed from the original statistical data, as inequality; (2) the significance of the effect of reimbursement ratio decreases in the *fairness gap* producing and widening in the later period, which probably implies that we should not expect the urban-rural disparities narrowed only by generally leveling the urban-rural reimbursement ratios. An inference drawn from the above is that in order to realize the EOp between urban and rural residents in health care, merely unifying the reimbursement policies is not enough; the widening urban-rural income gap should be taken into consideration. For the medical insurance itself, pro-disadvantage policies are necessary, according to the *maximin principle* of Roemer. In order to prove this point of view, we then use data from some URIMIS pilot regions in Jiangsu province for a further discussion. The results have well verified that pro-disadvantage policies[2] indeed have superiorities in narrowing the urban-rural *fairness gap* in health care.

The rest of this paper is organized as follows: section 2 is a simple description of the URIMIS; theory of the *equality of opportunity* and the axiomatic frameworks are introduced in section 3, where the illustration of the EOp in health care and our decomposition strategy of the *fairness gap* are also established; section 4 outlines data sources and variables; section 5 calculates and explains the urban-rural *fairness gaps*

[2] We give the definition in Section 6.

in health care by using the CHNS data, and gets some interesting results; in section 6, a further discussion, also a verification of our inference, is conducted by using dataset from the URIMIS pilot regions in Jiangsu province; and section 7 concludes.

2. URIMIS

The URIMIS tries to overcome the household registration restrictions, and unifies the two current separate medical insurance systems, the Medical Insurance for Urban Residents (MIUR) and the NCMS[3]. With raising reimbursement ratios—especially for rural residents—as one of the necessary steps, the URIMIS aims to ensure the same opportunities between urban and rural residents in health care and medical security, and to narrow or even eliminate the urban-rural disparities in health and health care. A sophisticated URIMIS will help to achieve social fairness in China.

The URIMIS is still at the exploring stage. Pilot experiments were set out first in some advanced regions, and formed various modes adapted to their own local characteristics. It was reported that five provincial administrative regions — municipalities of Tianjin and Chongqing, Qinghai province, Ningxia Hui autonomous region, and the Xinjiang Production and Construction Corps—and 41 prefecture cities, as well as 162 counties (districts, county-level cities), had already established the URIMIS at the end of 2011. Most of these URIMIS areas had drawn up integration strategies to bridge the gap between the NCMS and the MIUR. The advantages of the URIMIS have been affirmed by domestic researches, most of which, however, are just simple illustrations of the process of local URIMIS policies, due to the short pilot time and lack of data resources. These reviews and controversies are obviously deficient for the evaluation and comparison of pilot policies, since there has been no applicable and unified standard yet. It may fail to understand the real effectiveness and efficiency—and then to judge where to go—of different modes of the URIMIS when selecting, intentionally or unintentionally, an improper standard.

3. Theories and methods

3.1. Equality of opportunity

During the development of the equality of opportunity, Rawls (1971), who values *procedural equality* more than *outcome equality*, has made a huge contribution. Rawls points out that the public opportunities should be equally open to all individuals

[3] In fact, China never gives up the urban-rural coordination and integration during her rapid development, and the new century sees her much greater efforts. The URIMIS is just one part of the whole blueprint of urban-rural integration.

regardless of their races, religions or other factors, which represent the identities. This is written as one part of his second principle[4] of justice. Another part of the second principle is about the fair allocation and overall efficiency, usually called the *difference principle*, under which the most disadvantage group should be granted the maximal opportunity. Therefore, the *difference principle* is also called the *Rawls maximin principle*. Rawls's idea of the equality of opportunity has been further developed during the following decades. Sen (1980, 1999) emphasizes that people have the *capabilities* to choose the way of life they value most. Dworkin (1981a, 1981b) introduces the concepts of *equality of welfare* and *equality of resources*, suggesting that some disadvantages, which are out of individual control or without individual responsibilities, like circumstances and handicaps, should be compensated. Arneson (1989) and Cohen (1989) develop Dworkin's theory, and bring forward separately the concepts of *equality of opportunity for welfare* and *equality of access to advantage*. Based on these theories, Roemer (1993, 1998, 2002) proposes an axiomatic approach, which is becoming a famous framework for empirical studies on the equality of opportunity in the social science domain.

According to Roemer's framework of the equality of opportunity (EOp), one's *advantage* (y) is determined by two categories, *i.e. circumstances* (c) and *effort* (e); the former is beyond one's control, while the latter is not. The function is as the following:

$$y_i = y(c_i, e_i). \tag{1}$$

If we classify *circumstances* into J *types*, defining that people in the same kind of *circumstances* belong to the same *type*, then given one's *effort* $\tilde{e}$, the *advantage* he attains requires to be fixed no matter which *type* he belongs to. Thus a fair society, as Roemer (1998) explains, is a society that will maximize the *advantage* of those who possess the least *advantage*[5], *i.e.*

$$\max \min_{c} y(c, \tilde{e}). \tag{2}$$

Totaling the *advantage* of all individuals at each level of *effort*, we obtain:

$$\max \int_e \min_c y(c,e) f(e) de, \tag{3}$$

where $f(e)$ is the density function of the *effort*.

Roemer (1998, pp. 5－32) emphasizes that part of the *effort* can be affected by *circumstances*, which will indirectly affect the distribution characteristics of the

4 The first principle is about the priority of freedom, namely, it should be prior considered, on the premise that all people have equal freedom, to maximize the freedom that each one can enjoy.

5 It is worth noting that Roemer puts forward a somewhat different proposal from that of Rawls, who cares about how to maximize the minimum level of advantage, however, across all individuals regardless of their *types*.

advantage, and the society should take responsibility for this kind of interaction. Therefore, the *advantage* attainment should be in line with one's (relative) *degree of effort* in his own *type* rather than the (absolute) *level of effort*. In other words, a fair society guarantees people with the same *degree of effort* obtain the same *advantage* irrespective of their *types*; or, there is inequality of opportunity, and the society is no longer fair. As to the individual, one should take responsibility for, and only for, his *degree of effort* in his *type*; while he is not responsible for the distribution characteristics of the *effort*. In this way, Roemer defines one's *degree of effort* using the quantile π in the conditional distribution of his *type*. Thus (3) can be rewritten as (4), which can also be regarded as an explanation of the *maximin principle* of Roemer:

$$\max \int_{\pi} \min_{c} y(c,\pi) d\pi. \tag{4}$$

3.2. Inequality of opportunity in health and health care

The introduction of the equality of opportunity into the domain of health economics can be traced back to the 1980s. Daniels (1985, 1996) refers to Rawls' equality of opportunity and tries to make use of this theory into the analysis of health inequality. However, empirical work just sprang up during the last decade. Zheng (2006) introduces the income-health matrix to measure health opportunity and inequality caused by unequal health security circumstances and socioeconomic structure. Rosa Dias (2009) proposes straight forward the empirical application of Roemer's EOp. Using data from the UK National Child Development Study, he finds a significant inequality of opportunity in health, and that *circumstances*, such as parental socioeconomic status (SES) and childhood health, can affect the self-assessed health level in adulthood directly and indirectly(*e.g.* through *effort* such as education). Rosa Dias (2010) further improves and enriches the measurement of inequality of opportunity by combining Roemer's framework with the Grossman model of human capital and health demand, and discusses the *partial-circumstance problem*. Jusot *et al.* (2010) and Trannoy *et al.* (2010) do similar researches on the inequality of opportunity in adulthood health, with childhood condition as the important *circumstances*. Balia and Jones (2011) investigate a special case of health inequality, the inequality of opportunity in mortality risk among individuals who and whose parents smoke or ever smoked. The last three articles all emphasize both the importance of *circumstances* and the capabilities of change by *effort* for better conditions. Moreover, since health and education are vital types of human capital and are interrelated, Jones *et al.* (2012) analyze primarily the role of education in the inequality of opportunity in health, and note that there are significant and economically sizable linkages between the quality of education and health in some dimensions.

As mentioned before, researches on the inequality of opportunity in the health and health care domain are rather rare, not to mention relevant topics about China. This paper may be one of the first researches that combine the theory of the EOp and health care within the urban-rural dualistic background in China. We hope that our discussion in this paper will help to the further understanding of the urban-rural health care disparities and to the improvement of the URIMIS policy making.

3.3. Empirical strategy

3.3.1. *Reward principle* & *compensation principle*

For the EOp analysis, Fleurbaey and Schokkaert (2009, 2011), within their framework of selective egalitarianism, propose two principles—the *reward principle* and the *compensation principle*.

Reward principle encourages inequality caused by *effort*, *i.e.* differences of *advantage* are allowed if they are brought about by *effort*. For this reason, when measuring the EOp, influences from *effort* should be wiped off first. The typical method is to calculate the "corrected" advantage $\tilde{y}_i$ of individual i by fixing the value of *effort* $\tilde{e}$, i.e. $\tilde{y}_i = y(c_i, \tilde{e})$. In this way, we can obtain the *direct unfairness* by calculating the inequality in $\tilde{y}$ using traditional methods such as Gini index.

Compensation principle requires that the inequality caused by *circumstances* should be compensated. In other words, for the same *effort*, each individual should attain the same *advantage* whatever the *circumstances* he is in; or, compensation should be given to those who attain less *advantage*. Obviously, this principle has a close relationship with the *horizontal equity*, which indicates that the same health care need should receive the same health care regardless of one's income level, region or race, *etc*, all of these factors belonging to *circumstances*. The typical calculation procedure under the *compensation principle* is first to set an "ideal" distribution of c_i (c^*), and then we obtain the fair distribution of y_i (y_i^*) via $y_i^* = y(c^*, e_i)$. In this way, the unfair inequality of opportunity, i.e. the *fairness gap*, is $(y_i - y_i^*)$.

Though the two principles and their corresponding methods have something in common, they are in effect only compatible under one situation that c and e are completely independent, *i.e.* they are additively separable (Fleurbaey and Schokkaert, 2009). Therefore we need to choose between the two for empirical work where in most cases we cannot ignore the correlation of c and e.

This paper will base on the *compensation principle* in view of the following two reasons. First, what we care about is how to reimburse rural residents for their disadvantage of *circumstances*. This is much closer to the logic of the *compensation* *principle*. Second, *reward principle* is usually used to explain inequalities within a certain group, while *compensation principle*, between groups. We concern in this paper whether the same health care need attains the same health care between urban and rural residents. This is more in line with the *compensation principle*.

3.3.2. When Roemer meets Oaxaca

We define c as the indicator of household register (*hukou*). That is, c is a dummy variable indicating whether the individual is an urban resident (c=1) or a rural resident (c=0). Then the vector e includes all other factors which, during the analysis, will be classified into two components, e^1 and e^2. The vector e^1 is on behalf of factors whose correlation with c will bring about illegitimate urban-rural differences, *e.g.* income level and medical insurance types, *etc.* Contrarily, the vector e^2 is on behalf of factors which will not bring about illegitimate differences, *e.g.* health care needs (Fleurbaey and Schokkaert, 2011). In this way, the *advantage*, *i.e.* the health care use hc in our empirical research, can be expressed as a function of c, e^1 and e^2:

$$hc_i = \alpha + \beta\varphi(c_i) + \gamma\psi(e_i^1) + \delta\chi(e_i^2) + \varepsilon_i, \tag{5}$$

where β, γ and δ are parameters, α is the constant, and ε_i is an error item. What's more, in accordance with the definition of e^1, it is appropriate to regard e^1 as a function of c and π (the *degree of effort*), *i.e.*

$$e_i^1 = \eta(c_i, \pi_i^1). \tag{6}$$

Thus (5) can be rewritten as

$$hc_i = \alpha + \beta\varphi(c_i) + \gamma\psi \circ \eta(c_i, \pi_i^1) + \delta\chi(e_i^2) + \varepsilon_i. \tag{7}$$

A more general presentation of this function can be written as

$$hc_i = \alpha + \beta\varphi(c_i) + (\gamma + \mu c_i)\psi \circ \eta(c_i, \pi_i^1) + (\delta + \rho c_i)\chi(e_i^2) + \varepsilon_i, \tag{8}$$

where we add μ and ρ to separately express the coefficient differences of $\psi \circ \eta(c_i, \pi_i^1)$ and $\chi(e_i^2)$ between urban and rural groups.

Defining φ(1)=1, φ(0)=0, and taking urban circumstances (U) as the "ideal" reference background (c=1), then we obtain the *fairness gap* between urban and rural residents[6] as the following:

$$f.g. = \hat{\beta} + \hat{\rho}\chi(e_i^2 \mid R) + \hat{\gamma}[\psi \circ \eta(U, \pi_i^1 \mid R) - \psi \circ \eta(R, \pi_i^1 \mid R)] + \hat{\mu}\psi \circ \eta(U, \pi_i^1 \mid R). \tag{9}$$

The urban-rural inequality of opportunity in health care can be measured according to (9), from which we also obtain a decomposition formsimilar to what proposed by Oaxaca (1973). At the right hand of this equation, the constant term can

[6] According to Fleurbaey and Schokkaert (2009), the *fairness gap* should be $y(c_i,e_i)$- $y(c^*,e_i)$. However, in order to obtain positive values of the *fairness gap* and its components, we use the reverse value here. Since $y(c^*,e_i)$and $y(c_i,e_i)$ are the same for urban residents due to the construction of equation, this *fairness gap* in effect is the difference between the counterfactual estimate of the rural residents' health care expenditure in the urban circumstances and the actual health care expenditure of the rural residents.

be regarded as a coefficient of variable *I*, whose value is 1 invariably. Here we consider *I* as one of the elements of e^2. In this way, the former two terms $\hat{\beta}+\hat{\rho}\chi(e_i^2\,|\,R)$ can be considered as the coefficient effect of e^2, namely the e^2 *coefficient effect*. It indicates that part of the urban-rural health care *gap* is from the insufficient health care expenditure of rural residents, due to the urban-rural coefficient difference of e^2. The third term of this equation $\hat{\gamma}[\psi\circ\eta(U,\pi_i^1\,|\,R)-\psi\circ\eta(R,\pi_i^1\,|\,R)]$ can be regarded as the e^1 *environmental characteristic effect*, which indicates that part of the urban-rural health care *gap* is from the difference between the counterfactual characteristics of e^1 —the same rural residents with the same *degree of effort* and the same *effort* distribution characteristics but in the urban circumstances — and its actual characteristics when holding the coefficient of e^1 as constant as that of rural residents. The fourth term $\hat{\mu}\psi\circ\eta(U,\pi_i^1\,|\,R)$ can be regarded as the e^1 *environmental coefficient effect*, which indicates that part of the urban-rural health care *gap* is from the implacable urban-rural coefficient differences of e^1, even if rural residents are endowed with the same *circumstances* as urban residents and are then able to reproduce a new distribution of e^1.

In our empirical research, we specify the linear form

$$hc_i=\alpha+\beta c_i+(\gamma+\mu c_i)e_i^1+(\delta+\rho c_i)e_i^2+\varepsilon_i \tag{10}$$

for (8), and

$$e_i^1=a+bc_i+(d+lc_i)\pi_i^1+\tau_i \tag{11}$$

for (6), where in (11) *a* is the constant, *b*, *d* and *l* are parameters, and τ_i is an error item. Others keep the same meanings as before. The estimated results from (10) and (11) will then be taken into (12), *i.e.*

$$f.g.=\hat{\beta}+\hat{\rho}E(e_i^2\,|\,R)+\hat{\gamma}[E(U,\pi_i^1\,|\,R)-E(R,\pi_i^1\,|\,R)]+\hat{\mu}E(U,\pi_i^1\,|\,R), \tag{12}$$

for the calculation of the *fairness gap*.

It is worth noting that the methods of the π obtaining are different between the continuous variable and the discrete variable. For continuous variable such as income, the π—*degree of effort*—of individual can be obtained directly from his rank in urban or rural groups which he belongs to. However, for discrete variable such as self-reported health status, the method is more complicated. We need to know the propensity score of each individual in his own group with the help of logistic model, and then to obtain his π according to his score. Meanwhile, this paper uses the Geweke-Hajivassiliou-Keane (GHK) simulation (Gates, 2007) [7]—an approach of full

[7] As Gates (2007) explains, the GHK simulation has excellent features, and it is widely used in the health economics domain, e.g. Deb and Trivedi (2006), Balia and Jones(2008) and Rosa Dias(2010), *etc*. STATA has already developed the corresponding command *cmp*, which is detailedly introduced by Roodman (2009).

information maximum likelihood estimation—for the system estimation, allowing the error terms of (10) and (11) to be correlated.

4. Data

4.1. Data sources

The sample is from the CHNS (China Health and Nutrition Survey), which is held by the Carolina Population Center of the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. The CHNS, an ongoing research project, includes data waves in 1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009, covering urban and rural regions in nine provinces, which vary substantially in geography, economic development, public resources and health indicators. Sub-sample in each of the provinces was drawn via a multistage, random cluster process.

This paper uses data waves from 1997 to 2006, among which data from waves of 1997 and 2000 constitute the *period 1* group, and data from waves of 2004 and 2006 constitute the group of *period 2*. We make such data arrangement for the following reasons. First, in the analysis we only select respondents who have suffered from illnesses during the past four weeks. Relevant questions in waves of 1989, 1991 and 1993 were not consistent with those of the later waves. Besides, missing values in these waves are too common to complete the estimation. Hence we decide not to employ data from the 1989, 1991 and 1993 waves. Second, this paper wishes to propose, through the empirical analysis, some suggestions with practical values on the URIMIS policy making. The wave choosing is one of the keys to the conclusion drawing. Given that the URIMIS pilot actions have flourished since 2009, and there is no information can help us to distinguish regions which are in the pilot experiments from those which are not, we have to drop data in the 2009 wave for safety. Thirdly, the numbers of respondents who have suffered from illnesses during the past four weeks, in some waves, are not big enough. If we estimate using separately the rest four waves, it may discount the validity of our conclusions. Moreover, the NCMS was established in 2003, offering a natural and reasonable boundary for pooling the data. As a result, the final data only includes respondents who have suffered from illnesses during the past four weeks from waves in 1997, 2000, 2004 and 2006. And respondents from the former two waves are pooled to represent the characteristics of the *period 1*; while respondents from the latter two waves, the *period 2*.

4.2. Variables

For the measurement of the use of health care, we employ the health care expenditure during the past four weeks, as most literatures do. During the selection of independent variables and estimation, the key is how to differentiate between illegitimate factors and legitimate factors (Fleurbaey and Schokkaert, 2011). By reference of relative studies on racial/ethical disparities of health and health care (e.g. Institute of Medicine, 2003; McGuire *et al.*, 2006; Cook *et al.*, 2010; Fleurbaey and Schokkaert, 2011), we define that e^1 — vector of illegitimate factors — includes variables describing medical insurance policy, region and SES, *etc.*, and that e^2 — vector of legitimate factors — includes variables describing health care needs and individual preferences. Specifically, variables in e^1 can be classified into three parts: (1) SES variables including family per capita income and education; (2) policy variable, *i.e.* reimbursement ratio; and (3) health care environmental variables, including region, medicines availability and travel time for doctor visits. Variables in e^2 are classified into four parts: (1) demographic variables, including age, sex and marital status; (2) general health variables, including self-reported health status and chronic disease history; (3) health variables reflecting situations of illness, *i.e.* types of illness one had suffered from and the severity of the illness, during the past four weeks; and (4) preference variables, including treatment preferences and lifestyle preferences such as whether smoke or drink.

As is known, the actual reimbursement ratio — the proportion of health care expenditure paid for by medical insurance[8] — may be the best indicator to measure the insuring level and the health care economic burden, compared to indicators about whether one has participated in any medical insurance or what is the name of the participated medical insurance[9]. However, this is only feasible for respondents whose health expenditures are not zero. In the process of data disposing, we have done some adjustment to cope with the zero problems. For respondents who did participate in medical insurances but spent zero on health care, we take their self-reported policy reimbursement ratios[10] as replacements. If one's self-reported policy reimbursement ratio is missing, then we replace the missing value with the average ratio of other matched respondents who were in the same city, enjoying the same medical insurance and at the same health status as him.

Meanwhile, the treatment preferences are usually ignored in the health care

[8] In the CHNS questionnaires there are relevant questions which we can use directly for the measurement.

[9] Usually, there are three basic medical insurances to select, the NCMS, the MIUR, and the UEBMI (Urban Employees Basic Medical Insurance). The three constitute the basic medical insurance system in China.

[10] In the CHNS questionnaires the corresponding questions are "What percentage of the fees for outpatient care does your insurance pay (not including registration fee)" and "What percentage of the fees for inpatient care does your insurance pay (not including food expenses)".

researches, especially in relevant researches in China. In this paper we control the treatment preferences to some extent via the question of "what did you do when you felt ill". In addition, prices involved in our study are inflated to the 2009 level according to relevant information supplied by CHNS.

The final sample includes 4168 individuals, 1076 of which is from group of *period 1*, and 3092 is from group of *period 2*. In *period 1*, 412 respondents, making up 38.3% of the sub-sample, are from urban areas. And in *period 2*, there are 1283 urban respondents and 1809 rural respondents, the proportion of urban residents increasing to 41.5%. The description of variables is shown in Table 1, where we see obvious urban-rural differences in the past-four-week health care expenditure. The directly observed differences are 225.096 *yuan* and 268.149 *yuan* respectively in *period 1* and *period 2*, with the urban residents expending more in both periods. Urban-rural differences of SES variables, income and education, as well as policy variable, actual reimbursement ratio, are evident, too. Meanwhile, the urban-rural differences expressed by medical environmental variables in e^1 seem small, which are somewhat counter-intuitive. Maybe these available variables are not able to reflect the qualities of health care properly or completely, although they do show differences. However, they are still reserved for the *fairness gap* analysis out of consideration for comprehensiveness and completion.

[*Please insert Table 1 here*]

5. Results

How large are the urban-rural inequalities of opportunity in the use of health care? We turn to the decomposition strategy in 3.3.2 for analyzing each *fairness gap* in *period 1* and *period 2*. The results are shown in Table 2.

[*Please insert Table 2 here*]

When the urban circumstances are regarded as the "ideal" reference circumstances of *c*, just as Table 2 implies, the total *fairness gap* is 262.670 *yuan* in *period 1*. Given that the directly observed urban-rural difference in health care in the same period is 225.096 *yuan*, thus the ratio of the *fairness gap* to the directly observed average urban-rural difference (for short, observed difference) in heath care in *period 1* is 1.167. Intuitively, this ratio indicates that if we observe directly from the original data that urban residents on average spend 100 *yuan* more than rural residents on health care, then the truth conforming to the EOp is that urban residents should have spent averagely 16.7 *yuan* less than rural residents, *i.e.* the *fairness gap* will reach as much as 116.7 *yuan* if the result shows a 100-*yuan* difference between urban and rural residents. Similarly, the directly observed urban-rural difference in health care in *period 2* is 268.149 *yuan*, but the calculated *fairness gap* in the same period reaches as much as 467.521 *yuan*; therefore, the ratio in *period 2* is as high as 1.744. This number indicates that if rural residents are observed directly spending on average 100 *yuan* less than urban residents, the fact conforming to the EOp is that rural residents should have spent 74.4 *yuan* more on average. Since the *fairness gaps* of the two periods both exceed 100%, the urban-rural differences we observed straight forward from original statistical data have underestimated their essential inequities in both periods. Hence we may say that compared to the outcome inequality, the inequality of opportunity implies a much worse situation of rural residents in health care. Moreover, the value of the *fairness gap* in *period 2* is bigger than that of *period 1*, showing an increase of the inequality of opportunity as the time goes.

For the three components of the *fairness gap*, Table 2 shows that the e^2 *coefficient effects* are always predominant. The ratios of this effect to the observed difference are 0.674 in *period 1* and 1.173 in *period 2*, indicating that in the face of the same health care needs and the same preferences, the ratios of the urban-rural *gap*, which is caused by coefficient differences between urban and rural residents in health care, to the observed difference, reach as much as 0.674 and 1.173 respectively, accounting for 57.75% of the whole *fairness gap* in *period 1* and 67.25% in *period 2*. We may think about this effect and its importance from the aspects of health consciousness and service qualities. There is ingrained difference between urban and rural residents in the consciousness of health and health care use, urban residents preferring more to health investment. Meanwhile, there are differences in health service qualities between the urban and the rural, urban residents usually receiving better medicine and medical techniques.

The e^1 *environmental coefficient effect*, according to Table 2, does not play a big role, with the ratios of 8.5% and 4.8% in *period 1* and *period 2*, respectively. In addition, the ratios of e^1 *environmental characteristic effect* to the observed difference are 0.408 and 0.522, respectively, making up 34.96% of the whole *fairness gap* in *period 1* and 29.93% in *period 2*. The absolute contribution of the e^1 *environmental characteristic effect* to the *fairness gap* increases, while its relative contribution does in the opposite direction.

Since the reimbursement ratio is extensively concerned in the medical insurance system, here we take a look at it in the *fairness gap* producing. Table 2 shows an interesting change of effect caused by the reimbursement ratio. The reimbursement ratio, which plays a big role in *period 1* (the ratio is 0.236), shows little importance (the ratio is as little as 0.003) in *period 2*. One possible interpretation is that, *period 1* is before the establishment of the NCMS, when many rural residents were lack of sufficient and efficient medical insurances, and when participating in some medical insurances (*e.g.* the UEBMI), or more straightly speaking, enjoying a certain reimbursement in the outpatient or inpatient services, represented some kind of privilege, especially for urban residents. This is very important, since the privilege in health care usually relates to better health services and higher prices. On the one hand, the privilege encourages insureds to seek health care. On the other hand, non-insureds, especially poor rural residents, will be reluctant to purchase health care, unless they are seriously ill. As the urban residents—especially urban workers and government officers—and a few rich rural residents get most of the privilege, the urban-rural *fairness gap* expressed by the reimbursement ratio cannot be overlooked. While during the *period 2*, the NCMS has been already established, and more and more rural residents have participated, and enjoyed the reimbursement benefit. The reimbursement ratio is not a privilege for a certain group of people any longer, although there is still obvious difference on average between urban and rural residents, which we can see from Table 1. Therefore the effect of the reimbursement ratio becomes so small that we can even ignore it in *period 2*.

In view of the *index number problem* in the Oaxaca decomposition that the results from using different indexes may vary large, following the advice of DeMurger *et al.* (2007), we re-conduct the *fairness gap* decomposition, with rural circumstances (R) as the "ideal" reference circumstances, as a robustness test. Our conclusions above can still hold true according to the results shown in Appendix B Table B.1.

6. Further discussion

6.1. Preliminary inference

We see in Table 2 an increase of the *fairness gap* between *period 1* and *period 2*, and this increase is faster than that of the urban-rural observed difference. Although there is a clear rise of the reimbursement ratio for rural residents, which is shown in Table 1, the effect the reimbursement ratio has made to the *fairness gap* narrowing is rather small. So where is the problem?

As mentioned above, in *period 1* when the NCMS had not been established yet, many rural residents, especially the rural poor, were lack of sufficient and efficient medical insurance and health care services. As a result, the health care consumption in the rural was a kind of passive consumption. For most rural residents, going to hospital was the last resort. Therefore, income was almost irrelevant to the health care expenditure in this period. While in *period 2* when the NCMS had already been established, more and more rural residents participated in this medical insurance. The health-seeking behaviors and health perceptions changed gradually among rural residents, and the health care consumption became more and more positive. This can be proved by quantile regressions for rural residents (see Table 3). The results show that, the health care expenditure is not significantly dependent on income in *period 1*, except at the 0.9 quantile. While in *period 2*, this situation has been reversed. Therefore, the influence of income on the *fairness gap* increased (from -0.069 to 0.548, see Table 2), and income became one important factor for the *fairness gap* change.

[*Please insert Table 3 here*]

Since in recent years, the urban-rural income gap is widening (see Table 1), we believe that the big background of the increasing urban-rural income gap should be taken into consideration when improving medical insurance policies. Although it's not the main concern of medical insurance system to narrow the urban-rural income gap, such gap has already worsened the performance of medical insurance policies. There is no gainsaying the fact that relevant government sectors, which are responsible for the medical insurance policy making and supervision, have made great effort to narrow the urban-rural reimbursement difference. However, since the urban-rural income gap is widening, such effort may be counterproductive. Just as described in the Example C in Appendix A, the income gap can only counteract the good intentions of current medical insurance policies, being a hindrance for the URIMIS aims. Therefore, only generally leveling reimbursement ratios between urban and rural residents is now obviously insufficient to mitigate the urban-rural inequalities in health care, under the background of the income-gap widening. On the basis of Roemer's EOp, pro-disadvantage policies on reimbursement are highly desiderated.

The above is just our preliminary inference which needs further verification. Fortunately, in Jiangsu province, there are indeed some regions where the pro-disadvantage policies on medical insurance are implemented. We have made a special investigation from the URIMIS pilot regions in Jiangsu province. The data will be helpful as a further argument.

6.2. Jiangsu pilot URIMIS sample

The Jiangsu pilot URIMIS survey, adopting a multistage, random cluster method, had selected 6 regions[11] and lasted from December 2011 to April 2012. This survey

[11] They are Taicang, Wuxi, Wujin, Yixing, Xinghua and Jingjiang.

aimed at estimating the efficiency and differences in efficiency of various URIMIS modes in Jiangsu province. During the analysis in this paper, we classify the sample into two groups according to whether the regions had implemented pro-disadvantage policies in the URIMIS building. For judgment, we consult Gu and Li (2013, pp. 200 －205) and define the pro-disadvantage policies as policies that offer fiscal subsidies to those poor rural residents who want to participate in medical insurances with a higher security level. For instance, if a rural poor who should have participated in the NCMS, wants to and now has the chance to－with the help of premium subsidies－select the UEBMI or the MIUR, then we will say the local medical insurance policies are pro-disadvantage[12].

We select respondents who have got sick during the past one year[13]. At the mean time, respondents with missing values are dropped. The final sample includes 2065 individuals, among which 608 individuals are in regions where there are pro-disadvantage policies (*PH group*), while the rest 1457 individuals are not (*NPH group*). The *PH group* has 311 rural respondents and 297 urban respondents, while the *NPH group* has 766 and 691, respectively. Appendix B Table B.2 shows detailed information of the data.

6.3. Fairness-gap decomposition

Table 4 exhibits the decomposition－the strategy is similar to that in Section 5－of *fairness gaps* for both the *PH group* and the *NPH group*. An important finding is that the *fairness gaps* of the *PH group* are far less than those of the *NPH group*, no matter we take U or R as the reference circumstances. The main difference between the two groups is located in the e^1 *environmental characteristic effect*. These effects in the *NPH group* are noticeable, while in the *PH group* are not. The result implies that the influence power of the e^1 *environmental characteristic effect* is directly challenged in the *PH group*, since rural residents, who are with higher needs for health care but at lower income levels, are able to afford more health care in an advanced medical insurance system. Therefore, pro-disadvantage policies do improve the essential EOp between urban and rural residents in health care.

[*Please insert Table 4 here*]

Table 5 supports the pro-disadvantage policies from similar quantile regressions as Table 3 does. In the *NPH group*, correlation between income and health care

12 Compared with the other two, the NCMS reimbursement ratio is smaller. Since rural residents at the lowest income level usually need more health care but cannot pay the bill, such pro-disadvantage policies will improve their affordability and reduce the health risks brought about by passive health care consumption.

13 The questionnaire of this survey is a little different from relevant parts of the CHNS questionnaire. Therefore we change a few variables for the analysis in this section, which we can see from Appendix B Table B.2.

expenditure is significant for most quantiles; while such correlation in the *PH group* is not any significant. It is not difficult to understand. Comparing the *NPH group* with Table 3, we see an improvement of the reimbursement policies, since the health care use of the rural poorest (at the 0.1 quantile) becomes sensitive to their incomes, which shows an active consumption that we have expected to see. However, the *NPH* strategy is not sufficient if the URIMIS wants to reduce the urban-rural inequality of opportunity in health care as much as possible. We find better results in the *PH group*, where the *fairness gaps* are much smaller (see Table 4), and where the health care use seems unrelated to one's income, reflecting to some extent a based-on-need allocation of health care. Therefore, the insignificance of the correlation between the health care expenditure and income in the *PH group* does not tell the same thing as in *period 1*. And compared with Table 3, Table 5 also possesses a different explanation for the insignificance at the 0.1 quantile.

[*Please insert Table 5 here*]

Due to lack of specific questions about diseases in the pilot URIMIS survey in Jiangsu province, there may be some bias in the estimation and calculation, affecting the robustness of conclusions. However, we believe that our conclusions here are still meaningful. What's more, since this survey data is of cross section data, the *average effect of treatment on the treated* (ATT) of the *PH group* cannot be obtained from direct comparison with the *NPH group*. It is proved that under such non-randomized trial, the approach of *propensity score match* (PSM) may maximally mitigate the effect caused by the confounding bias and the sample selection bias (Rosenbaum and Rubin, 1985; Heckman *et al.*, 1998). Therefore this paper conducts four methods of PSM for analyzing the ATT. The results—shown in Table 6—indicate that, the pro-disadvantage policies can narrow the *fairness gap* of urban-rural health care use by as much as 27%, when we take U as the "ideal" reference circumstances, and 58%, when we take R as the "ideal" reference circumstances. At this moment, we believe we have proved our inference described in 6.1 that pro-disadvantage policies will help to the realization of the EOp in health care between urban and rural residents.

[*Please insert Table 6 here*]

7. Conclusions

As one important component of the human capital, health is the basic premise for work, and is also vital to the human welfare (Schultz, 1961; Deaton, 2003). Meanwhile, the health care inequalities would seriously harm the social welfare just as the income inequalities do. Thus it is of great importance to focus on the issue of equity in health care. Mooney (1986) points out that equality should enjoy the priority in the trade-offs of efficiency and equality in terms of health. Sen (2002) also proposes that the equity of health care is one of the major parts of justice for a country, and that the basic health care system should guarantee the civil rights to receive health.

Rural residents have made great contribution to China's economic development. However, what they share from the prosperity is far less than what they should obtain. The inequality in health care is just one conspicuous aspect among the urban-rural illegitimate gaps. Since the 21st century, China has been improving the rural health and health care conditions with great effort, including the expansion of the NCMS, the increase of the NCMS reimbursement ratios, and the exploration of the URIMIS. During the improvement, it is being heatedly discussed, but without an agreement, on how to effectively reduce even eliminate the urban-rural disparities in health care. This paper suggests that, focusing on the urban-rural inequality of opportunity is much more meaningful than focusing on the urban-rural *outcome equality* or *reimbursement equality* in health care. And generally leveling the reimbursement ratios between urban and rural residents is not sufficient to realize the EOp in health care; pro-disadvantage policies are needed.

This paper analyzes from a broader perspective based on the theory of the EOp. We apply the framework of the *compensation principle* proposed by Fleurbaey and Schokkaert (2011) as the base for empirical analysis, and the corresponding *fairness gap* as a measurement of the urban-rural inequality of opportunity in health care. The Oaxaca decomposition is established and we define three components of the *fairness gap*, the e^2 *coefficient effect*, the e^1 *environmental characteristic effect*, and the e^1 *environmental coefficient effect.* We first measure the *fairness gaps* using data from CHNS in 1997—2000 and 2004—2006. The results indicate that a direct observation of the urban-rural differences from original statistical data may underestimate the essential inequalities. In addition, we have noticed a dramatic change of the effect of reimbursement ratio during the two periods. Through further analysis, we infer that since the urban-rural income gap is widening, generally leveling reimbursement ratios between urban and rural residents becomes insufficient to mitigate the urban-rural inequalities in health care. Then a question may arise on how to make use of the medical insurance policies in the URIMIS. We give our suggestion which is in line with the idea of Roemer(1998). According to Roemer, in an ideal equal world, resources should not be distributed on the basis of (absolute) *level of effort* of individuals especially when they are in different *types*, because *circumstances* may affect *effort*. Thus we believe that only generally leveling the reimbursement ratios between urban and rural residents is deficient for the health care equality, and the urban-rural income gap, which becomes wider and wider in recent years, should also be taken into consideration in the URIMIS. Therefore, we suggest that under current situation, pro-disadvantage policies should be made to help improve the affordability of the rural poor. This suggestion is also in accordance with the Roemer's *maximin principle*, which calls for the maximization of the *advantages* of those who possess the most disadvantages. Meanwhile, our suggestion is, fortunately, well verified by the pilot URIMIS data in Jiangsu province. The results show that the urban-rural *fairness gap* in health care can be narrowed significantly via pro-disadvantage policies.

There inevitably are some limitations in our research. The decomposition strategy may need further modification for accuracy. In addition, we use data from Jiangsu province as a supplementary support of our proposition. The data may not be on behalf of the whole China URIMIS pilot conditions, although it has covered the northern, middle and southern parts—the three major economic zones—of Jiangsu province, and is able to represent the characteristics of the URIMIS modes in Jiangsu and other advanced provinces. Nevertheless, as mentioned before, this paper is a preliminary study, using the theory of the EOp of Roemer, on China's special medical insurance policies, in order to provide some useful suggestions on the further improvement of the medical insurance systems. We hope that this paper will inspire more interest in the conceptualization and measurement of the urban-rural health care justice in China.

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Highlights

- Roemer's theory of equality of opportunity (EOp) has drawn more and more attention in the health economics domain. While relevant studies on China issues are rather rare. This paper just tries to combine the theory of the EOp and the urban-rural health care problems in China to help understand the urban-rural health care inequalities from a new perspective.
- It is well known that there are wide disparities in health care between urban and rural residents in China. The new program, which we call URIMIS (the urban-rural integrated medical insurance system) in this paper, is focusing on mitigating such disparities. However, as the program is still in the pilot phase, a universally valid strategy remains to be determined. What's more, there has been, to the best of our knowledge, no relevant study on the URIMIS in the international academic circle by now. This paper may be the first discussion on this issue, and we will give our suggestion based on the EOp for the achievement of the URIMIS targets.
- Our suggestion on the URIMIS policy making keeps in line with the idea of Roemer. First, in an ideal equal world, according to Roemer, resources should not be distributed on the basis of (absolute) *level of effort* of individuals especially when they are in different *types*, because *circumstances* may affect *effort*. This paper believes that only generally leveling the reimbursement ratios between urban and rural residents is deficient for the health care equality, and the urban-rural income gap, which becomes wider and wider in recent years, should also be taken into consideration. Second, Roemer's *maximin principle* calls for the maximization of the *advantage* of those who possess the most disadvantage. This paper suggests that in the URIMIS, pro-disadvantage policies are needed in order to better mitigate, or even eliminate, the health care inequalities between urban and rural residents.

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Table 1
Description of variables.

Variables	Period 1				Period 2			
	Urban		Rural		Urban		Rural	
	Mean	Sd.	Mean	Sd.	Mean	Sd.	Mean	Sd.
y								
Health care expenditure during the past 4 weeks	779.758	2201.553	554.663	2189.791	709.827	5039.766	441.677	2351.327
e^1								
Family per capita income (yuan/year)	6943.783	7030.383	4569.000	5328.661	10729.150	10548.700	5796.847	8870.297
Formal education years	7.124	4.730	5.066	4.031	7.836	4.819	5.516	4.181
Reimbursement ratio (%)	26.036	37.793	6.143	23.223	25.116	34.834	9.360	24.019
Region (1= the east region, 0= others)	0.383	0.487	0.325	0.469	0.486	0.500	0.411	0.492
Travel time (min.) by bike to health facility	17.197	20.373	16.089	18.706	14.499	14.464	13.439	17.789
Medicines availability(1=yes, 0=no)	0.951	0.215	0.967	0.179	0.988	0.111	0.985	0.121
e^2								
Basic Demographic Information								
Age (years)	53.008	16.252	52.322	15.692	54.145	15.897	55.435	14.686
Sex (1=male，0=female)	0.422	0.495	0.438	0.497	0.434	0.496	0.423	0.494
Marital status (1= married, 0= others)	0.801	0.400	0.797	0.403	0.796	0.403	0.811	0.392
General Health Information								
Self-reported health status (4=excellent, 3=good, 2=fair, 1=poor)	2.138	0.750	2.056	0.819	2.228	0.797	2.061	0.785
Ever diagnosed High blood pressure (1=yes, 0=no)	0.182	0.386	0.148	0.355	0.246	0.431	0.170	0.376
Diabetes (1=yes, 0=no)	0.158	0.365	0.123	0.329	0.194	0.396	0.132	0.339

Myocardial infarction (1=yes, 0=no)	0.015	0.120	0.014	0.116	0.014	0.118	0.009	0.094
Apoplexy (1=yes, 0=no)	0.039	0.193	0.027	0.163	0.034	0.180	0.025	0.156
Illness During the Past 4 Weeks								
Suffered from chronic or acute diseases (1=yes, 0=no)	0.874	0.332	0.883	0.322	0.634	0.482	0.669	0.471
Got fever, sore throat or cough (1=yes, 0=no)	0.359	0.480	0.357	0.479	0.373	0.484	0.362	0.481
Got diarrhea or stomachache (1=yes, 0=no)	0.126	0.332	0.131	0.338	0.156	0.363	0.153	0.360
Got headache or dizziness (1=yes, 0=no)	0.306	0.461	0.283	0.451	0.253	0.435	0.265	0.441
Got joint pain or muscle pain (1=yes, 0=no)	0.165	0.372	0.181	0.385	0.260	0.439	0.281	0.450
Got rash or dermatitis (1=yes, 0=no)	0.032	0.175	0.024	0.153	0.036	0.186	0.024	0.152
Got eye/ear disease (1=yes, 0=no)	0.034	0.181	0.026	0.158	0.062	0.240	0.050	0.217
Got heart disease/chest pain (1=yes, 0=no)	0.102	0.303	0.069	0.254	0.112	0.316	0.082	0.274
Got other infectious disease (1=yes, 0=no)	0.032	0.175	0.032	0.175	0.047	0.211	0.050	0.217
Got noncommunicable disease (1=yes, 0=no)	0.158	0.365	0.149	0.356	0.244	0.430	0.187	0.390
Severity of the illness (3=quite severe, 2=somewhat severe, 1=not severe)	1.740	0.689	1.640	0.674	1.687	0.657	1.702	0.665
Inpatient visits (1=yes, 0=no)	0.092	0.290	0.074	0.262	0.031	0.174	0.030	0.170
Preferences								
What to do when felt ill (4=none, 3=saw a doctor, 2=saw the local health worker, 1=self care)	2.522	0.908	2.706	0.751	2.074	1.168	2.472	1.048
Ever smoked (1=yes, 0=no)	0.250	0.434	0.304	0.460	0.313	0.464	0.307	0.462
Drink alcohol last year (1=yes, 0=no)	0.316	0.465	0.280	0.449	0.341	0.474	0.280	0.449
Number of sub-sample	412		664		1283		1809	

Source: CHNS data (1997, 2000, 2004 and 2006).

Note: “Sd.” denotes standard deviation.

Table 2

Decomposition of the fairness gaps using CHNS data.

	Period 1		*Period 2*	
Directly observed average differences	225.096		268.149	
	Fairness gap	Ratio	*Fairness gap*	Ratio
***e^2 coefficient effect*:**				
Age	387.248	1.720	-801.470	-2.989
Male	76.158	0.338	251.163	0.937
Married	-123.302	-0.548	-105.519	-0.394
Self-reported health: fair	166.831	0.741	-593.614	-2.214
Self-reported health: good	56.920	0.253	-305.803	-1.140
Self-reported health: excellent	18.001	0.080	-29.494	-0.110
High blood pressure	54.396	0.242	0.897	0.003
Diabetes	-79.090	-0.351	51.664	0.193
Myocardial infarction	6.067	0.027	-4.507	-0.017
Apoplexy	7.781	0.035	-3.898	-0.015
Suffered from chronic or acute diseases	667.391	2.965	-165.665	-0.618
Got fever, sore throat or cough	-136.195	-0.605	90.036	0.336
Got diarrhea or stomachache	-28.023	-0.124	-44.276	-0.165
Got headache or dizziness	78.907	0.351	-48.257	-0.180
Got joint pain or muscle pain	-1.126	-0.005	41.766	0.156
Got rash or dermatitis	4.013	0.018	40.411	0.151
Got eye/ear disease	-42.756	-0.190	24.671	0.092
Got heart disease/chest pain	34.711	0.154	63.017	0.235
Got other infectious disease	39.230	0.174	17.924	0.067
Got noncommunicable disease	-64.060	-0.285	46.340	0.173
Severity of the illness: somewhat severe	111.614	0.496	-4.149	-0.015
Severity of the illness: quite severe	82.171	0.365	133.673	0.499
Inpatient	-8.388	-0.037	43.000	0.160
To see local health worker when felt ill	0.692	0.003	-20.647	-0.077
To see a doctor when felt ill	163.488	0.726	189.518	0.707
To do nothing when felt ill	31.194	0.139	55.693	0.208
Smoke	-3.613	-0.016	-54.234	-0.202
Drink	-165.846	-0.737	-103.918	-0.388
Wave	-27.906	-0.124	-99.114	-0.370
Intercept	-1154.844	-5.130	1649.307	6.151
Sub-total	**151.663**	**0.674**	**314.513**	**1.173**
e^1 environmental characteristic effect:				
Family per capita income	-15.542	-0.069	147.014	0.548
Education	70.475	0.313	13.324	0.050
Reimbursement ratio	53.126	0.236	0.793	0.003
East China	-8.402	-0.037	-20.763	-0.077
Travel time to health facility	-9.245	-0.041	-0.729	-0.003
Medicines available	1.352	0.006	0.373	0.001

Sub-total	**91.763**	**0.408**	**140.011**	**0.522**
e^1 environmental coefficient effect:				
Family per capita income	-28.221	-0.125	87.714	0.327
Education	129.135	0.574	16.578	0.062
Reimbursement ratio	16.633	0.074	10.050	0.037
East China	-34.839	-0.155	-64.626	-0.241
Travel time to health facility	-68.028	-0.302	21.779	0.081
Medicines available	4.564	0.020	-58.499	-0.218
Sub-total	**19.244**	**0.085**	**12.997**	**0.048**
Total	**262.670**	**1.167**	**467.521**	**1.744**
Number of sub-sample	1076		3092	

Note: "Ratio" in the 3rd and 5th column denotes the ratio of the decomposed *fairness gap* as well as the total *fairness gap*, *i.e.* each cell in the 2nd and 4th column, to the directly observed average difference in the corresponding period.

Table 3

Quantile regressions of health care expenditure on income using CHNS data (rural residents).

Quantile	0.1	0.25	0.5	0.75	0.9	Number of sub-sample
Period 1	0.025 (0.036)	0.024 (0.022)	0.026 (0.021)	0.025 (0.020)	0.036* (0.021)	664
Period 2	0.015 (0.025)	0.040*** (0.014)	0.032*** (0.010)	0.018* (0.010)	0.007 (0.013)	1809

Note: all variables are listed in Table 1; the dependent variable is the log of family per capita income; the independent variable is the log of health care expenditure; other control variables are not shown here; ***, **, * represents significance at the level of 0.01, 0.05 and 0.10, respectively.

Table 4

Decomposition of the *fairness gap* using Jiangsu data.

	U as the reference *c*		Robustness test: R as the reference *c*	
	Fairness gap	Ratio	*Fairness gap*	Ratio
NPH group				
Directly observed average difference	496.780			
e^2 coefficient effect	208.544	0.420	287.731	0.579
environmental e^1 characteristic effect	201.116	0.405	224.092	0.451
environmental e^1 coefficient effect	-182.754	-0.368	62.296	0.125
Total	226.907	0.457	574.118	1.156
Number of sub-sample	1457			
PH group				
Directly observed average difference	130.001			
e^2 coefficient effect	66.259	0.510	61.196	0.471
environmental e^1 characteristic effect	-17.271	-0.133	14.339	0.110
environmental e^1 coefficient effect	-24.159	-0.186	-0.803	-0.006
Total	24.829	0.191	74.732	0.575
Number of sub-sample	608			

Note: "Ratio" in the 3rd and 5th column denotes the ratio of the decomposed *fairness gap* as well as the total *fairness gap*, *i.e.* each cell in the 2nd and 4th column, to the directly observed average difference in the corresponding group.

Table 5

Quantile regressions of health care expenditure on income using Jiangsu data (rural residents).

Quantile	0.1	0.25	0.5	0.75	0.9	Number of sub-sample
NPH group	0.055***	0.025***	0.013***	0.007***	0.0003	766
	(0.013)	(0.009)	(0.030)	(0.002)	(0.009)	
PH group	-0.016	-0.003	-0.001	-0.001	0.0001	311
	(0.021)	(0.011)	(0.008)	(0.004)	(0.002)	

Note: all variables are listed in Appendix B Table B.2; the dependent variable is the log of family per capita income; the independent variable is the log of health care expenditure; other control variables are not shown here; ***, **, * represents significance at the level of 0.01, 0.05 and 0.10, respectively.

Table 6

Fairness gaps under four PSM methods.

		U as the reference circumstances				Robustness test: R as the reference circumstances			
		T size	C size	ATT (% of fairness gap)	Standard deviation	T size	C size	ATT (% of fairness gap)	Standard deviation
Nearest neighbor matching method	e^2 *coefficient effect*	311	157	0.040	0.062	297	199	-0.157***	0.045
	e^1 *environmental characteristic effect*	311	157	-0.475***	0.056	297	199	-0.350***	0.031
	e^1 *environmental coefficient effect*	311	157	0.162***	0.023	297	199	-0.127***	0.013
	Total	311	157	-0.272***	0.082	297	199	-0.634***	0.056
Radius matching method	e^2 *coefficient effect*	311	728	0.090**	0.043	297	679	-0.107***	0.032
	e^1 *environmental characteristic effect*	311	728	-0.534***	0.028	297	679	-0.340***	0.019
	e^1 *environmental coefficient effect*	311	728	0.180***	0.022	297	679	-0.132***	0.011
	Total	311	728	-0.263***	0.057	297	679	-0.579***	0.039
Layered matching method	e^2 *coefficient effect*	311	728	0.088*	0.056	297	679	-0.117***	0.036
	e^1 *environmental characteristic effect*	311	728	-0.531***	0.050	297	679	-0.337***	0.022
	e^1 *environmental coefficient effect*	311	728	0.176***	0.023	297	679	-0.133***	0.011
	Total	311	728	-0.267***	0.060	297	679	-0.587***	0.046
Kernel matching method	e^2 *coefficient effect*	311	728	0.085	0.057	297	679	-0.112***	0.036
	e^1 *environmental characteristic effect*	311	728	-0.530***	0.044	297	679	-0.339***	0.022
	e^1 *environmental coefficient effect*	311	728	0.173***	0.023	297	679	-0.132***	0.012
	Total	311	728	-0.272***	0.068	297	679	-0.583***	0.043

Note: "T size" denotes the sample size of treatment groups; "C size" denotes the sample size of control groups which include those living in where there are no pro-disadvantage policies; ***, ** and * represents the significance level of 0.01, 0.05 and 0.10, respectively.

Appendix A

Examples of the Misleading Aspects of the *Outcome Equality* and *Reimbursement Equality* in the Health Care Analysis

In the introduction of this paper, we endorse the idea that we should focus on the essential equity, *i.e.* the *equality of opportunity* (EOp), rather than the *outcome equality* or the *reimbursement equality* of health care. Here we give three examples as a simple explanation. Example A and B explain the misleading use of the *outcome equality*, and Example C, the *reimbursement equality*.

Example A: Suppose the aging proportion is higher among urban residents, who involuntarily have more health need, and thus more health care expenditure, than rural residents. Such urban-rural differences due to demographic characteristics are indeed reasonable and desirable, reflecting the effective allocation of health resources. Under such situation, policies need no interfere, while purchasing the *outcome equality* may result in inefficiency.

Example B: Suppose there are two residents belonging respectively to the urban and rural areas. The health care expenditure of the rural resident should have been 1000 *yuan* because of his serious illness. However, as lack of money or effective medical security, his actual expenditure is only 500 *yuan*. Meanwhile, the urban resident, who enjoys a more generous medical insurance, spends the same 500 *yuan* for a health problem, such as flu, which could have been cured with the expense of only 100 *yuan*. There seems no inequality from straightforward the aspect of actual expenditure on health care. However, the essential inequality was concealed.

Example C: Suppose there are two residents belonging respectively to the urban and rural areas and enjoying the same reimbursement of 50%. One day, they both are attacked by a same disease, such as flu. However, the rural resident decides not to see a doctor because of lack of money, but the urban resident does. Then, the premium paid by the rural resident in effect is used to reimburse the urban resident, resulting in the phenomenon of *the rural help the urban* or *the poor help the rich*, although we are reluctant to face it. Thus when we judge based on the *reimbursement equality*, such as whether there are unified reimbursement policies for both urban and rural residents, there may also be essential inequalities.

Therefore, if we judge the urban-rural equality or inequality from the viewpoint of the *outcome equality* or the *reimbursement equality*, we may miss the essential inequality. Policies based on these theories may lead to inefficiency, even inequity. A broad view is needed in analyzing inequalities of the urban-rural health care use, and the theory of *equality of opportunity* (EOp) can avoid such mistakes or disadvantages we illustrate in the above examples.

Appendix B

Table B.1
Robustness test of Table 2: rural as the reference circumstances.

	Period 1		*Period 2*	
Directly observed average differences	225.096		268.149	
	Fairness gap	Ratio	*Fairness gap*	Ratio
***e^2 coefficient effect*:**				
Age	392.324	1.743	-782.817	-2.919
Male	73.391	0.326	257.510	0.960
Married	-123.965	-0.551	-103.547	-0.386
Self-reported health: fair	192.867	0.857	-556.721	-2.076
Self-reported health: good	61.505	0.273	-410.789	-1.532
Self-reported health: excellent	13.187	0.059	-39.637	-0.148
High blood pressure	67.092	0.298	1.297	0.005
Diabetes	-101.040	-0.449	75.892	0.283
Myocardial infarction	6.518	0.029	-7.149	-0.027
Apoplexy	11.146	0.050	-5.252	-0.020
Suffered from chronic or acute diseases	660.779	2.936	-156.815	-0.585
Got fever, sore throat or cough	-137.071	-0.609	92.643	0.345
Got diarrhea or stomachache	-26.994	-0.120	-45.075	-0.168
Got headache or dizziness	85.231	0.379	-46.166	-0.172
Got joint pain or muscle pain	-1.028	-0.005	38.642	0.144
Got rash or dermatitis	5.254	0.023	60.954	0.227
Got eye/ear disease	-56.747	-0.252	30.534	0.114
Got heart disease/chest pain	51.078	0.227	86.451	0.322
Got other infectious disease	39.139	0.174	16.848	0.063
Got noncommunicable disease	-67.785	-0.301	60.327	0.225
Severity of the illness: somewhat severe	122.736	0.545	-4.157	-0.016
Severity of the illness: quite severe	103.797	0.461	124.753	0.465
Inpatient	-10.483	-0.047	44.911	0.167
To see local health worker when felt ill	0.367	0.002	-8.647	-0.032
To see a doctor when felt ill	151.617	0.674	124.701	0.465
To do nothing when felt ill	26.976	0.120	53.760	0.200
Smoke	-2.969	-0.013	-55.150	-0.206
Drink	-186.812	-0.830	-126.831	-0.473
Wave	-24.483	-0.109	-97.180	-0.362
Intercept	-1154.844	-5.130	1649.307	6.151
Sub-total	**170.783**	**0.759**	**272.597**	**1.017**
e^1 environmental characteristic effect:				
Family per capita income	-0.874	-0.004	72.381	0.270
Education	18.030	0.080	6.352	0.024
Reimbursement ratio	16.448	0.073	-16.123	-0.060
East China	-2.170	-0.010	-9.087	-0.034

Travel time to health facility	-4.561	-0.020	-2.447	-0.009
Medicines available	2.793	0.012	0.519	0.002
Sub-total	**29.667**	**0.132**	**51.594**	**0.192**
e^1 environmental coefficient effect:				
Family per capita income	-42.889	-0.191	162.347	0.605
Education	181.580	0.807	23.550	0.088
Reimbursement ratio	53.310	0.237	26.966	0.101
East China	-41.072	-0.182	-76.301	-0.285
Travel time to health facility	2.187	0.010	-58.644	-0.219
Medicines available	-72.712	-0.323	23.497	0.088
Sub-total	**80.404**	**0.357**	**101.414**	**0.378**
Total	**280.854**	**1.248**	**425.605**	**1.587**
Number of sub-sample	1076		3092	

Note: "Ratio" in the 3rd and 5th column denotes the ratio of the decomposed *fairness gap* as well as the total *fairness gap*, *i.e.* each cell in the 2nd and 4th column, to the directly observed average difference in the corresponding period.

Table B.2

Description of variables of the Jiangsu survey data.

	Names of variables	*NPH Group* Rural Mean	Sd	Urban Mean	Sd	*PH Group* Rural Mean	Sd	Urban Mean	Sd
y	Health care expenditure in the past year	1798.922	6824.057	2295.702	7926.267	2541.514	7840.156	2671.515	8891.821
e^1	Family per capita income (yuan/year)	15155.300	9106.527	19132.640	10200.820	13206.500	6069.876	18156.630	9523.793
	Formal education years	6.759	4.008	9.065	4.497	5.797	3.998	8.862	4.663
	Reimbursement ratio (%)	0.201	0.325	0.317	0.410	0.333	0.313	0.415	0.381
	Walking time to the neatest health facility (h.)	0.301	0.481	0.296	0.427	0.329	0.675	0.213	0.149
	Insurance type(1=UEBMI,2=MIUR,3=NCMS)	2.086	0.837	1.508	0.500	1.540	0.499	1.498	0.501
e^2	age	44.556	18.973	42.253	19.540	54.235	19.363	44.949	19.733
	Sex(1=female，0=male)	0.486	0.500	0.456	0.498	0.534	0.500	0.448	0.498
	Marital status (1= married, 0= others)	1.008	0.592	0.978	0.686	0.865	0.342	0.714	0.453
	Household size	3.414	1.192	3.449	1.042	3.386	1.257	3.694	1.141
	Self-reported health status(1=excellent, 2=good, 3=fair, 4=poor, 5=very poor)	3.354	1.217	3.467	1.183	2.916	1.172	3.155	1.195
	Whether have chronic diseases (1=yes, 0=no)	0.230	0.421	0.287	0.452	0.286	0.453	0.239	0.427
	Whether been in hospital last year (1=yes, 0=no)	0.110	0.313	0.107	0.309	0.125	0.332	0.135	0.342
	Severity of the illness (3=quite severe, 2=somewhat severe, 1=not severe)	1.892	0.607	1.795	0.662	1.807	0.668	1.758	0.627
	Temporal disability days	12.764	55.217	13.187	55.755	6.794	32.453	9.239	44.022
	What to do when felt ill (1= self care, 2=saw the local health worker, 3=saw a doctor, 1= none)	2.433	0.988	2.363	1.035	2.055	0.977	2.111	1.019
Number of sub-sample		766		691		311		297	

Source: Authors' survey.

Note: "Sd." denotes the Standard deviation.